2010 Local Government Operations Energy Use and Emissions Inventory

City of Bloomington, Indiana

Produced by the City of Bloomington
Department of Economic & Sustainable Development, March 2012
With assistance from ICLEI – Local Governments for Sustainability USA

CITY OF BLOOMINGTON

Credits and Acknowledgements

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Introduction

The consumption of energy from fossil fuels has a number of negative implications. It creates air pollution, stretches the capacity of expensive, sometimes vulnerable utility infrastructure, and reduces the funds available for investment in our community and its residents. It also increases greenhouse gas emissions and thus the profound threat of climate change. Much of the world's oil originates in distant, sometimes unstable or hostile areas of the world, making the United States vulnerable to political or other disruptions in oil supply. These effects in turn pose substantial risks to the future well-being, stability, security, and prosperity of our community.

In Indiana, our nearly complete dependence on coal for electricity creates unique complications for energy use. Underground and surface mining of coal has significant impacts on air, water, and land quality, and the effects of acid mine drainage and mountaintop removal coal mining have devastated communities in mining areas. Mining and burning coal release numerous pollutants, including mercury, methane, and carbon dioxide. The costly and controversial expansion of the Edwardsport coal plant, underway as of the fall of 2011, demonstrates the challenges we face when we reach the production limits of our existing infrastructure.

While it is unlikely that our need for fossil-fuel based energy will disappear in the foreseeable future, there is great potential to reduce our dependence upon it. The amount of energy that could be saved in the United States with minimal impacts on function and comfort has been estimated to be as high as 60 to 70 percent[1]. Indiana in particular could benefit from efficiency: According to the U.S. Energy Information Administration, Indiana ranks second in the U.S. in its consumption of coal, 13th in its consumption of natural gas, 14th in petroleum, and 11th in terms of both retail electricity sales and per capita consumption[2].

Nevertheless, multiple barriers to energy efficiency exist: Budgets are tight and getting tighter, making it difficult to find funds for the up-front capital costs of improvements. We lack information on what improvements will be most cost-effective. The effects of excessive energy use are diffuse, as is responsibility for improving efficiency. And we have limited information on how, where, and when we use the most energy.

The City of Bloomington,Indiana has taken action to better understand the potential to reduce our dependence on fossil fuels within City government by completing this Energy Use and Emissions Inventory. In assembling this report we hope to facilitate more responsible energy management by

[1] http://www.grist.org/article/2009-09-11-how-much-energy-does-the-us-waste is one example of such a calculation.
[2] State Energy Data System, http://205.254.135.24/state/seds/hf.jsp?incfile=sep_sum/html/rank_use_per_cap.html

evaluating all uses of energy within City of Bloomington government. The information presented here will enable us to identify priority areas for efficiency improvements, and reduce negative environmental impacts, energy bills, and vulnerability to external shocks. We also hope to inspire action throughout the Bloomington community.

This report builds on previous efforts to reduce the community's environmental impact. In April 2006, the City of Bloomington signed on to the U.S. Mayor's Climate Protection Agreement, committing to reduce greenhouse gas emissions of the community at large to seven percent below 1990 emission levels by 2012. In 2009, through the Department of Energy (DOE) Energy Efficiency and Conservation Block Grant program, Bloomington received funding to carry out energy improvements on a number of City buildings. Also in 2009, the City Council passed the Green Building Ordinance, requiring that all qualifying City buildings be certified at the Silver level through the Leadership in Energy and Environmental Design (LEED) Program of the US Green Building Council. This inventory supports Bloomington's long-term efforts to reduce energy use and is critical to establishing a more sustainable future.

The Energy Use and Emissions Inventory is a means of both raising awareness and of managing and reducing energy use—and its costs—over time. With increasing constraints on local government budgets, responsible resource management is becoming more and more critical. Presented here are data on energy use levels, costs, and emissions resulting from the City's government operations in 2010. This information that is key to guiding local reduction efforts. These data will provide a baseline against which the City will be able to compare future performance and demonstrate progress in reducing emissions.

Inventory Methodology

This inventory includes all "civil city" operations (Parks & Recreation, Public Works, Planning, Housing & Neighborhood Development, etc.) plus Police and Fire, Utilities, and the Bloomington Transit Authority. Although the Transit Authority and Utilities both maintain some autonomy from the civil city, the organizational and budgetary ties among these organizations were considered significant and thus both were included.

Staff of the Department of Economic & Sustainable Development used the Local Government Operations Protocol (LGOP) and the Clean Air and Climate Protection (CACP) 2009 Software (version 2.2.1b) to inventory energy use and emissions from City of Bloomington operations.

Because of complications in obtaining complete data for years prior to 2010 (particularly with respect to the City's vehicle fleet), we elected to use 2010 as our baseline year. All future reduction targets will be made with respect to this year.

For more details on the methodology used to conduct this inventory and associated calculations, see Appendix A.

A note on units of measurement: Throughout the report, the amount of energy used is reflected in MMBtu, or millions of British Thermal Units. This allows us to compare energy use regardless of energy source. As a point of reference, the US Energy Information Administration shows that the average U.S. home uses about 38 MMBtus (or 11,000 kilowatt-hours (kWh)) of electricity per year.

Emissions are shown in equivalent tons of carbon dioxide (CO_2). This also allows us to standardize among different fuel sources and to measure the relative impacts of each

Data Sources

This inventory evaluates government emissions by the sectors listed in Table 1.

In general, we relied on records already maintained by City staff to obtain our data. Fuel data for all vehicles and equipment except Transit vehicles were obtained from a spreadsheet maintained by the Fleet Department. Transit fuel data was obtained from Transit directly, as were electricity and natural gas usage data for Transit buildings.

Table 1: Government Sectors
Buildings & Facilities
Streetlights & Traffic Signals
Water Delivery Facilities
Wastewater Facilities
Vehicle Fleet
Transit Fleet
Mobile Source Refrigerants
Other Process Fugitive Emissions

All other electricity and natural gas data were obtained from spreadsheets maintained by the Public Works and Utilities Departments. Usage data from Parks facilities had to be pulled directly from archived paper bills (for electricity) and from the Vectren website (for natural gas) since detailed usage information is not currently being tracked in this department.

Refrigerant information was received from the Public Works Facilities Management Coordinator for Public Works facilities and from Fleet for non-Transit vehicles. Complete data was not available from all departments, but this is not expected to contribute significantly to emissions.

All tables and figures in the report were produced using Local Governments for Sustainability (ICLEI) Clean Air and Climate Protection 2009 Software.

Government Operations Energy Use and Emissions Inventory Results

The City of Bloomington spent over $4.8 million for energy purchases in 2010, including expenditures for electricity, vehicle fuel, and natural gas. This resulted in the emission of 41,129 tons of carbon dioxide, or approximately 1,028 pounds of CO_2 per resident of Bloomington. Other significant emissions included 128 tons of nitrogen oxides (NO_x) and 207 tons of sulfur oxides (SO_x).

Usage and Emissions by Sector and Source

Emissions from local government operations are produced by a number of sources (purchased electricity, natural gas, vehicle fuel, etc.) and span several sectors (buildings and facilities; water delivery systems, vehicles, etc.). This section of the report presents detailed findings of emissions by sector and source, reviews the largest source (electricity), and discusses the Buildings & Facilities and Vehicle Fleet sectors specifically.

Local Government Energy Use, Costs, and Emissions by Sector

The City's water delivery and wastewater facilities are the single largest source of energy consumption in City operations, accounting for 44 percent of the City's energy expenditures, 45 percent of usage, and 60 percent of emissions. Vehicle fuel (including both Bloomington Transit and the City fleet) is the next-largest category, accounting for 30 percent of energy expenditures, 33 percent of usage, and 16 percent of emissions. City Buildings & Facilities account for under 20 percent of energy expenditures, usage, and emissions. Finally, Streetlights & Traffic Signals account for nine percent of energy expenditures, and roughly five percent of usage and emissions (Table 2; Figures 1, 2 and 3).

Table 2: Government Operations Use and Emissions by Sector

Sector	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Energy (%)	Cost ($)	Cost (%)
Wastewater Facilities	12,516	30%	58,346	23%	$1,011,915	21%
Water Delivery Facilities	12,408	30%	56,396	22%	$1,099,458	23%
Buildings and Facilities	7,502	18%	44,388	18%	$792,880	16%
Transit Fleet	3,276	8%	40,647	16%	$685,300	14%
Vehicle Fleet	3,273	8%	42,957	17%	$784,844	16%
Streetlights & Traffic Signals	2,080	5%	9,182	4%	$438,456	9%
Mobile Source Refrigerants	55	<1%	NA	NA	NA	NA
Other Process Fugitive	20	<1%	NA	NA	NA	NA
Total	**41,129**	**100%**	**251,916**	**100%**	**4,812,853**	**100%**

Figure 1: Energy Consumption by City Government Sector (2010)

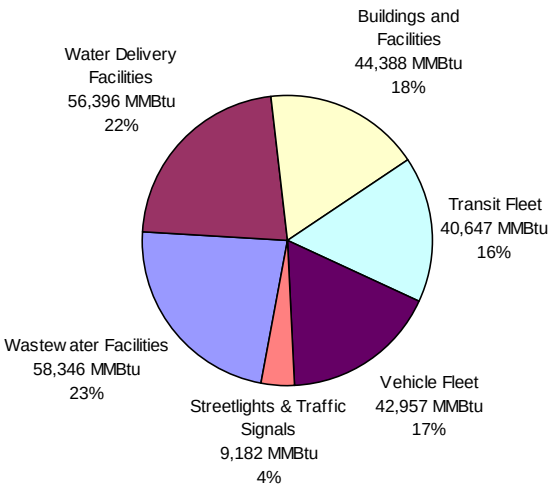


Figure 2: Cost of Energy by City Government Sector (2010)

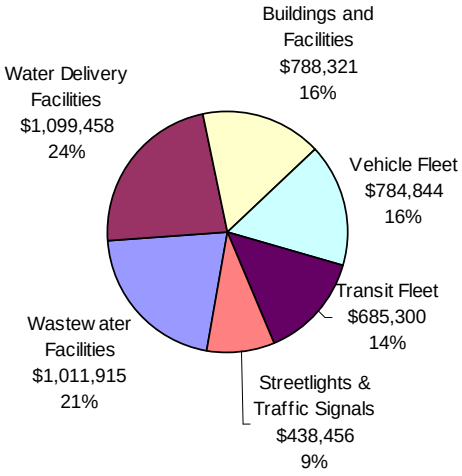
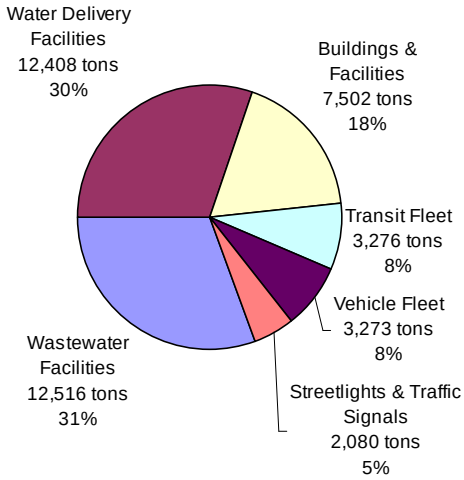


Figure 3: Equivalent CO_2 Emissions by City Government Sector (2010)



Local Government Energy Use, Cost, and Emissions by Source

The cost, usage, and emissions of energy by city government are dominated by purchased electricity, which in Bloomington is largely produced from coal. Electricity makes up 66 percent of the cost, 57 percent of the quantity, and 80 percent of the emissions. This is followed by diesel fuel and then gasoline (Table 3; Figures 4, 5 and 6).

Table 3: Use, Emissions and Cost of Energy by Source (2010)

Sector	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBTU)	Energy (%)	Cost ($)	Cost (%)
Electricity	32,780	80%	144,710	57%	$3,152,444	66%
Diesel	4,389	11%	54,377	22%	$936,915	19%
Gasoline	2,145	5%	27,126	11%	$477,110	10%
Natural Gas	1,384	3%	23,602	9%	$190,265	4%
Other*	431	1%	2,101	1%	56,119	1%
Total	**41,129**	**100%**	**251,916**	**100%**	**$4,812,853**	**100%**

*"Other" includes biodiesel (B100), and other fuels and refrigerants.

Figure 4: Energy Consumption by Energy Source for City Operations

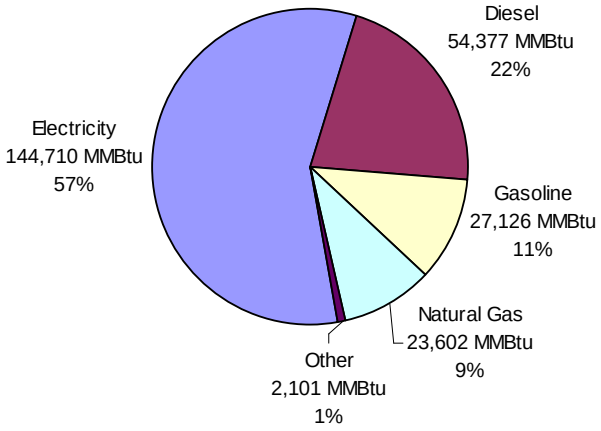


Figure 5: Cost by Energy Source for City Operations (2010)

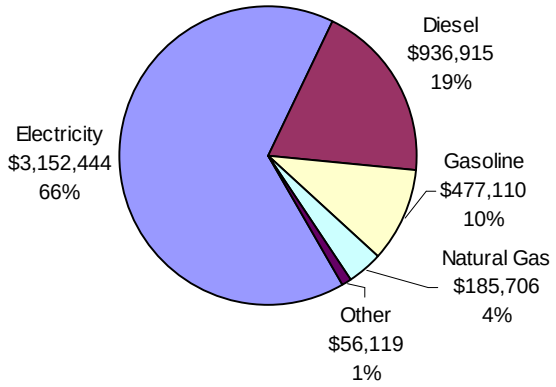
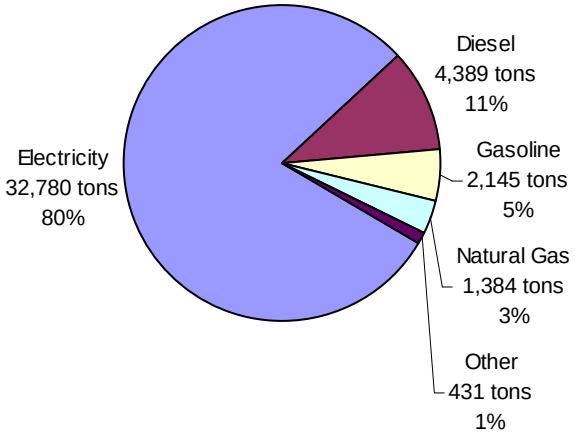


Figure 6: Equivalent CO_2 Emissions by Energy Source for City Operations (2010)



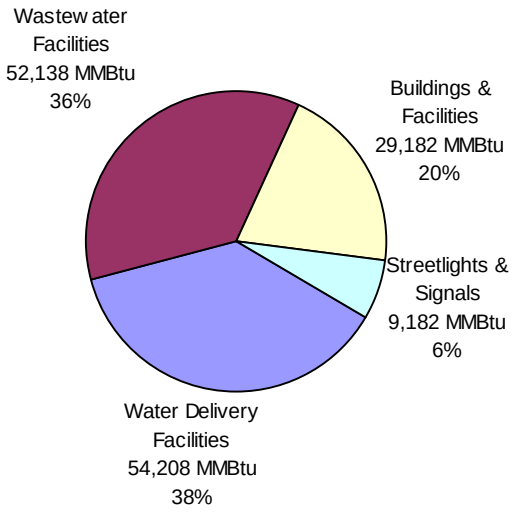
Electricity Usage Breakdown

Electricity makes up the vast majority of energy consumed in City of Bloomington operations, and water and wastewater facilities account for the majority (73%) of electricity consumption. Buildings and non-water treatment facilities account for 20 percent and streetlights and traffic signals for just 6 percent (Table 4, Figure 7).

Table 4: Electricity Use by City Government Sector

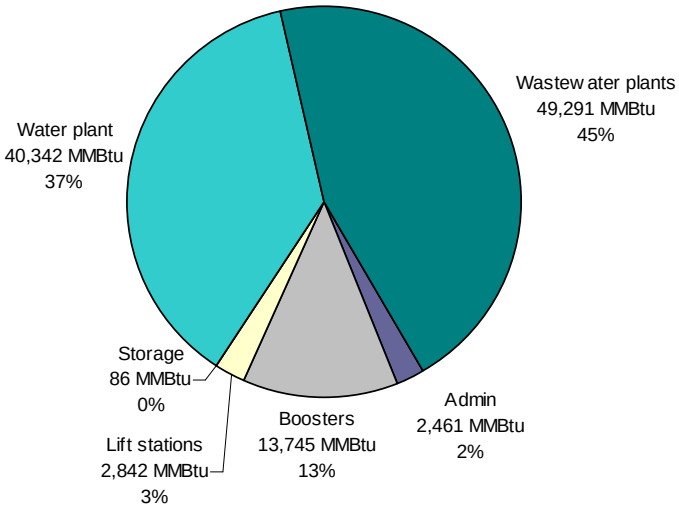
Sector	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Energy (%)	Cost ($)	Cost (%)
Water Delivery Facilities	12,279	37%	54,208	37%	$1,081,120	34%
Wastewater Facilities	11,810	36%	52,138	36%	$964,030	31%
Buildings & Facilities	6,610	20%	29,182	20%	$668,838	21%
Streetlights & Signals	2,080	6%	9,182	6%	$438,456	14%
Total	**32,780**	**100%**	**144,710**	**100%**	**$3,152,444**	**100%**

Figure 7: Electricity Usage by City Government Sector (2010)



Within the water and wastewater treatment sectors, the vast majority of the power used is for treatment plant operation, including six million kilowatt-hours (kWh) to pump water up from Lake Monroe to the plant for treatment (Figure 8). While the community is fortunate to have a secure, safe, and ample water supply, residents of the Bloomington community may not have a good understanding of the impact water treatment and distribution have on energy use.

Figure 8: Breakdown of Electricity Use by Water and Wastewater Facilities (2010)



Buildings & Facilities (Non-Water Treatment Facilities only)

Within City of Bloomington operations, four sub-units are responsible for building and facility management: Public Works, Parks & Recreation, Public Works, Bloomington Transit, and Utilities. Of these, Public Works facilities (30 total) account for the largest percentage of costs (46%), usage (45%), and emissions (46%). Parks facilities (71 total) account for roughly 40 percent of costs, usage, and emissions. Non-water treatment Utilities facilities (four properties) account for nine percent, and Transit facilities (two properties) account for roughly six percent (Table 5, Figure 9).

Note that Public Works properties tend to be larger facilities, like City Hall, the parking garages, and the police station. Many Parks accounts are smaller facilities (like batting cages and park shelters). Unfortunately, square footage data was not available for all facilities so a per-square-foot comparison was not possible at this time. This data is being gathered and will be used in future reports.

Table 5: Energy Usage and Emissions by City Department (Buildings and Non-Water Treatment Facilities only)

Department		Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Energy (%)	Cost ($)	Cost (%)
Public Works	Electricity	3,080		13,596		$312,819	
	Natural Gas	365		6,227		$51,776	
Subtotal Public Works		**3,412**	**46%**	**19,823**	**45%**	**$364,595**	**46%**
Parks & Recreation	Electricity	2,620		11,566		$271,014	
	Natural Gas	327		5,584		$47,349	
Subtotal Parks & Rec		**2,947**	**39%**	**17,150**	**39%**	**$318,363**	**40%**
Utilities	Electricity	555		2,452		$54,953	
	Natural Gas	100		1,709		$13,211	
Subtotal Utilities		**656**	**9%**	**4,161**	**9%**	**$68,164**	**9%**
Transit	Electricity	355		1,567		$30,052	
	Natural Gas	99		1,687		$11,706	
Subtotal Transit		**454**	**6%**	**3,254**	**7%**	**$41,758**	**5%**
Total Buildings and Facilities		**7,469**	**100%**	**43,828**	**100%**	**$788,321**	**100%**

Figure 9: Building Energy Usage by City Department (2010)

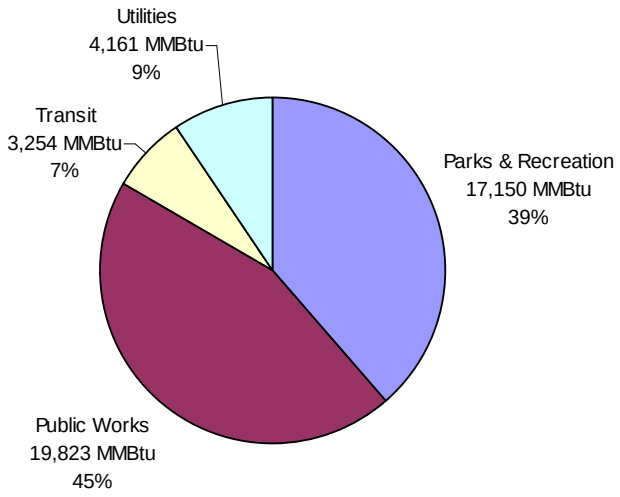


Table 6 summarizes information for the top natural gas and electricity users in the City-owned building sector. Where available, usage per square foot has been included. Facilities that have high overall usage, high usage per square foot, or that appear on both lists may be good candidates for targeted energy efficiency improvements.

Table 6: Top Energy Consumers from the Building Sector

Top Natural Gas Users					Top Electricity users			
Facility Name	**Annual therms**	**Annual Cost**	**Therms/ sq ft**		**Facility Name**	**Annual kWh**	**Annual Cost**	**kWh/ sq ft**
Frank Southern Ice Arena	26,437	$21,832	0.83		City Hall	1,424,125	$101,100	22
Animal Shelter	18,552	$14,343	2.49		Twin Lakes Rec Center	1,415,520	$105,050	14
Utilities Service Center	17,086	$13,211	0.81		Utilities Service Center	607,840	$46,519	29
Grimes Transit Center	15,450	NA	NA		Police Headquarters	591,200	$38,077	54
Twin Lakes Rec Center	9,233	$6,836	0.09		Garage Market	453,840	$25,621	3
Banneker	7,022	$6,160	1.08		Frank Southern Ice Arena	451,800	$29,747	14
Fire Station #1	5,628	$4,606	0.56		Grimes Transit Center	435,900	NA	NA

Vehicle Fleet

As noted above, the transportation sector (including both Bloomington Transit and the general City fleet) is the second-largest (after water and wastewater treatment) category of energy use, accounting for 32 percent of energy expenditures, 36 percent of usage, and 15 percent of emissions (Table 2). Transit fleet and City fleet (which includes Utilities, Police, Fire, Street, Traffic, Sanitation, and all other City-owned vehicles) both account for roughly half of total fuel consumption by the City of Bloomington (Table 7).

Transit vehicles provide over 3 million rides throughout the community each year. Transit continues to reduce fuel consumption by purchasing more efficient hybrid buses for its fleet.

Table 7: Vehicle Fuel Breakdown

Department	Fuel type	Equiv CO2 (tons)	Equiv CO2 (%)	Energy (MMBtu)	Energy (%)	Cost ($)	Cost (%)
Vehicle Fleet	Diesel	1,283		15,897		$296,730	
	Gasoline	1,975		24,959		$431,995	
	Biodiesel	0.15		1,912		$52,421	
Subtotal Vehicle Fleet		**3,258**	**54%**	**42,768**	**55%**	**$781,146**	**53%**
Transit Fleet	Diesel	2,601		32,227		$640,185	
	Gasoline	170		2167		$45,115	
Subtotal Transit Fleet		**2,771**	**46%**	**34,394**	**45%**	**$685,300**	**47%**
Total Vehicle Fuel		**6,029**	**100%**	**77,162**	**100%**	**$1,466,446**	**100%**

Figures 10 through 12 show the breakdown of vehicle fuel use by fuel type. Diesel fuel accounts for the largest proportion (more than 60 percent) of cost, usage, and emissions attributable to vehicle fuel.

Figure 10: Vehicle Fuel Use by Fuel Type (2010)

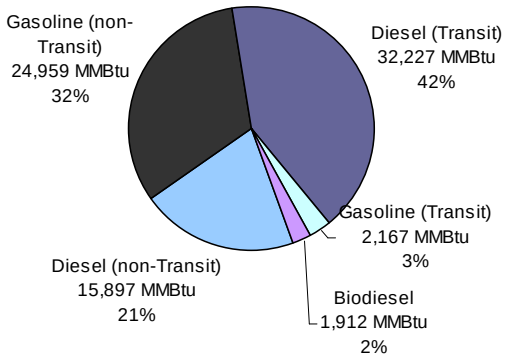


Figure 11: Cost of Vehicle Fuel by Fuel Type (2010)

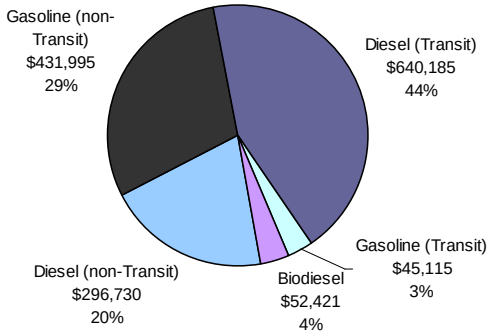
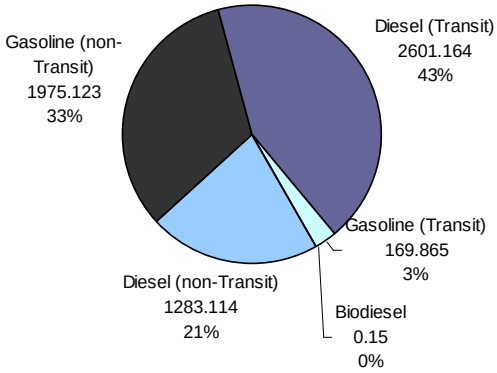


Figure 12: Equivalent CO_2 Emissions associated with Vehicle Fuel (2010)



Within the *non-Transit* segments of the City fleet, fuel use varies significantly. The Police Department consumes the largest amount of gasoline, at nearly 72,000 gallons per year, followed by Utilities (41,000

gallons), and Parks & Recreation (24,000 gallons). Diesel fuel consumption is highest in the Utilities Department (39,000 gallons), followed by the Street Department (35,000 gallons), Sanitation (23,000 gallons), and Fire (17,000 gallons).

Figures 13 and 14 provide details on non-Transit fuel consumption.

Figure 13: Gasoline Consumption by City Department (Transit excluded) (2010)

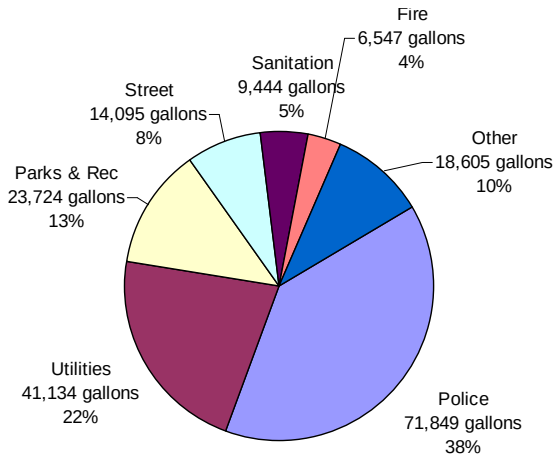
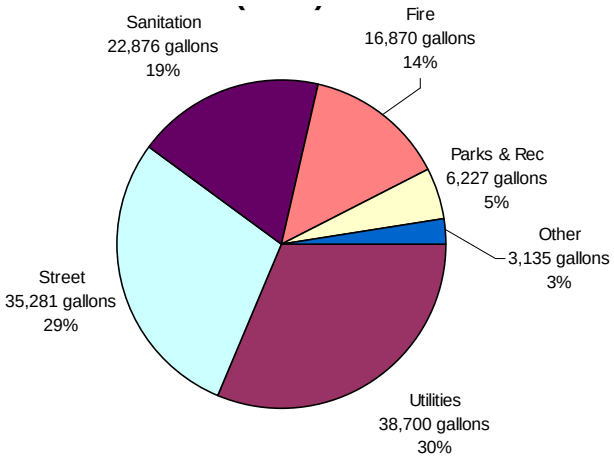


Figure 14: Diesel Consumption by City Department (Transit excluded) (2010)



Accurate miles-per-gallon figures are not available for all vehicles, but a per-vehicle fuel consumption calculation is useful to identify possible targets for improvement. Sanitation trucks consumed over 1,800 gallons of diesel per vehicle in 2010; Fire vehicles consumed nearly 1,300 gallons of diesel per vehicle.

Consumption of diesel per vehicle is likewise high for Utilities vehicles, at just over 1,000 gallons per vehicle per year (Figure 15).

Police vehicles are by far the largest consumers of gasoline, burning over 1,200 gallons per vehicle (Figure 16).

Figure 15: Average Diesel Consumption per Vehicle (2010)

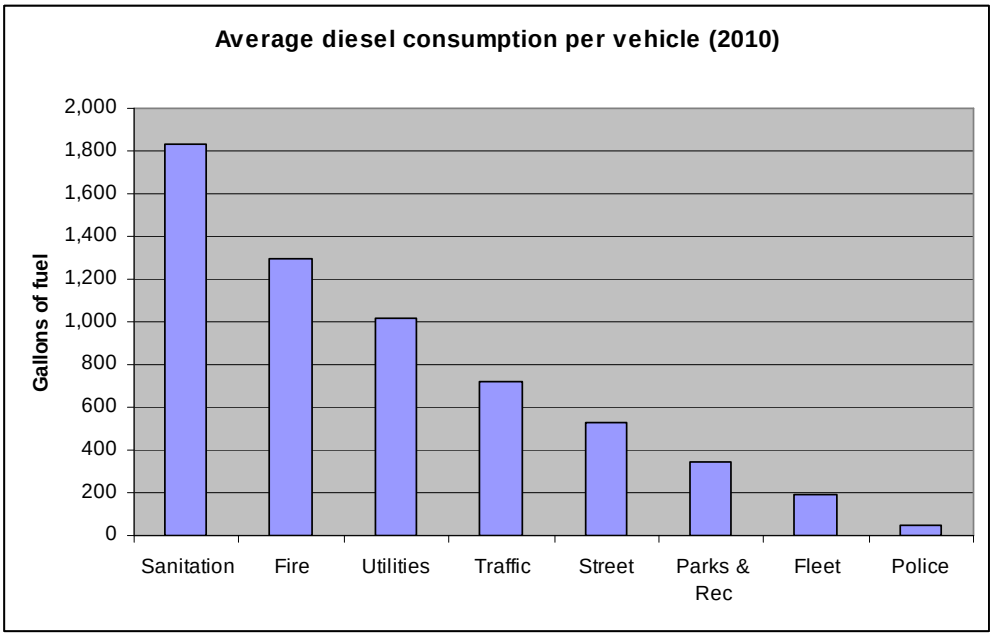
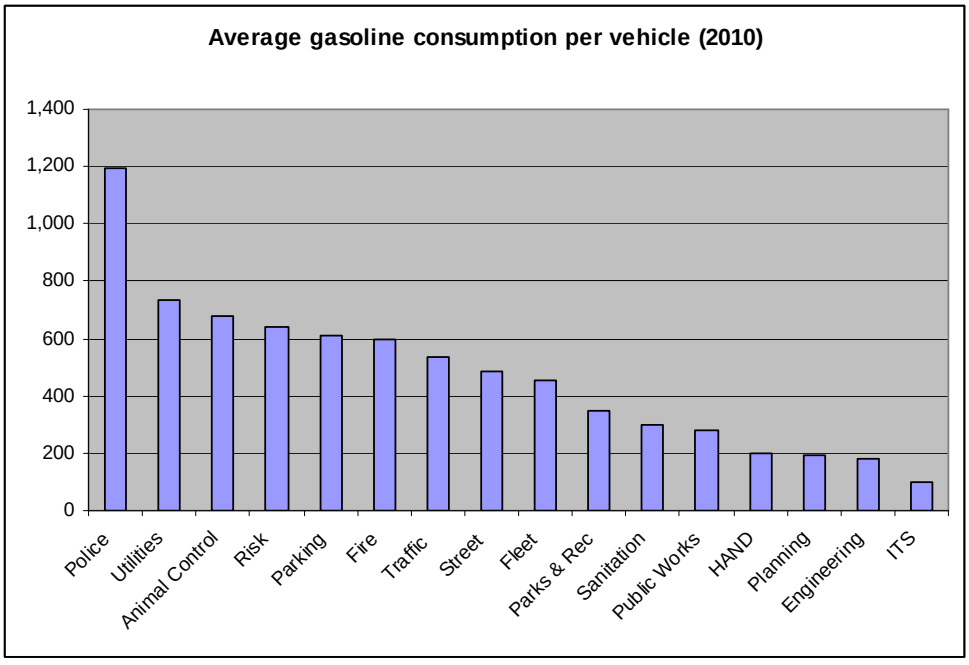


Figure 16: Average Gasoline Consumption per Vehicle (2010)



Given both the total and per-vehicle quantities of fuel consumed, Sanitation, Utilities, and Police may offer prime opportunities for training in efficient driving techniques, vehicle replacement, or other fuel reduction efforts. Other departments may benefit from these efforts as well.

Conclusion and Recommendations

The City of Bloomington made a formal commitment to reduce its energy consumption and greenhouse gas emissions by passing a resolution in 2006 to endorse the U.S. Conference of Mayors Climate Protection Agreement. The City has taken further initiative to reduce energy use by adopting a green building ordinance, hiring a sustainability coordinator, and evaluating energy use in major City facilities. This energy use and emissions inventory provides baseline levels against which future progress can be demonstrated.

This analysis found that the City of Bloomington spent over $4.8 million for energy purchases in 2010, including expenditures for electricity, vehicle fuel, and natural gas. Of the total expenditures, over $3 million was spent on electricity, making electricity usage the most likely candidate for targeted reductions.

More specifically, the City's water supply and wastewater treatment facilities account for nearly 75 percent of electricity used. Therefore any meaningful reduction in energy use will need to focus on these facilities. The Utilities Department has already made strides in both understanding and improving its efficiency, and is likely to make even greater improvements with the hiring of a resource efficiency coordinator next year.

Opportunities exist for improvements at other buildings as well—HVAC and lighting improvements at City Hall, the Twin Lakes Recreation Center, and Garage Art have already resulted in significant energy savings, and staff are continuing to identify energy efficiency investments with short-term payback periods. Because of their high overall usage and high use per square foot, Frank Southern Ice Arena, the Banneker Center, police headquarters, and the Utilities Service Center may offer additional opportunities for targeted energy efficiency improvements.

With respect to vehicle fuel, which accounts for another $1.4 million in expenditures, opportunities exist throughout the fleet for improved driving techniques, high-efficiency vehicles, and other improvements. Because of both total and per-vehicle fuel consumed, Sanitation, Utilities, and Police may offer particular opportunities for improvements.

Short-term recommendations:

- **Ensure that all departments are tracking not just cost but quantities of energy and water consumption.** While bill amounts are important, rate increases, riders, and other charges can mask the total energy consumption and make it difficult to monitor trends.
- **Continue gathering usage data for specific buildings to help identify candidates for targeted improvements and upgrade investments.** Facilities that have high overall usage, high usage per square foot, or that have both high electricity and high natural gas usage may be good candidates for targeted energy efficiency improvements.
- **Explore fuel saving technology, efficient driving techniques, and vehicle replacements for high-consumption departments and vehicle types.**
- **Make energy efficiency a priority at Utilities.** Because Utility facilities account for such a large percentage of overall energy expenditures and consumption, any meaningful energy reduction initiative must include improvements in these facilities. An energy management team already exists; they should be given as much support as possible.

As Bloomington strives to become more sustainable, the City should identify and quantify the possible benefits of energy and fuel efficiency, renewable energy, alternative transportation, vehicle trip reduction, land use and transit planning, waste reduction and other strategies. Through these efforts and others the City of Bloomington can save money and improve the community's economic vitality and its quality of life.

Appendices

Appendix A: Inventory Methodology

Staff of the Department of Economic & Sustainable Development used the Local Government Operations Protocol (LGOP) and the Clean Air and Climate Protection (CACP) 2009 Software (version 2.2.1b) to inventory energy use and emissions from City of Bloomington operations. The government operations inventory is a subset of the community inventory (most recently completed in 2009). By analyzing emissions in this manner, Bloomington's local government can understand its own impact within the community and lead by example.

Local Government Operations Protocol

In 2008, Local Governments for Sustainability (ICLEI), the California Air Resources Board, and the California Climate Action Registry released the LGOP to serve as a national appendix to the International Emissions Analysis Protocol.[3] The LGOP serves as the national standard for quantifying and reporting the impact of energy consumption associated with local government operations. The purpose of the LGOP is to provide the principles, approach, methodology, and procedures needed to develop a local government operations inventory.

Quantifying Energy Use and Emissions

Establishing a Base Year

The first step toward achieving tangible reductions in energy use and emissions is to define a baseline year. Because of complications in obtaining complete data for years prior to 2010 (particularly with respect to the City's vehicle fleet), we elected to use 2010 as our baseline year. All future reduction targets will be made with respect to this year.

Establishing Government Operational Boundaries

According to the LGOP, a government can use two approaches to define its organizational boundary for reporting greenhouse gas emissions: activities and operations that the jurisdiction controls operationally, and activities and operations that the jurisdiction controls financially. Staff estimated Bloomington's local government emissions based on activities and facilities for which the City maintains operational control.

[3] Local Government Operations Protocol (LGOP). http://www.icleiusa.org/programs/climate/ghg-protocol/ghg-protocol

This includes all "civil city" operations (Parks & Recreation, Public Works, Planning, Housing & Neighborhood Development, etc.) plus Police and Fire, Utilities, and the Bloomington Transit Authority. Although the Transit Authority and Utilities both maintain some autonomy from the civil city, the organizational and budgetary ties among these organizations were considered significant and thus both were included.

Emission Types

The LGOP recommends assessing emissions from the six internationally recognized greenhouse gases regulated under the Kyoto Protocol as listed in Table 1. City staff included data on all six gases; however, hydrofluorocarbon data are incomplete since usage information was not available for Parks and Utilities facilities. Perfluorocarbons and sulfur hexafluoride were considered but do not account for a measurable portion of City-related emissions.

Greenhouse gas emissions are commonly aggregated and reported in terms of equivalent carbon dioxide units, or CO_2e. This standard is based on the global warming potential of each gas, which is a measure of the amount of warming a greenhouse gas may cause, measured against the amount of warming caused by carbon dioxide. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is 21 times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat, so the CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents. See Table 1 for the global warming potential of the commonly occurring greenhouse gases.

Table 1: Greenhouse Gases

Greenhouse Gas	Chemical Formula	Global Warming Potential
Carbon Dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310
Hydrofluorocarbons	Various	43-11,700
Perfluorocarbons	Various	6,500-9,000
Sulfur Hexafluoride	SF_6	23,900

Quantification Methods

The emissions estimates contained in this inventory rely primarily on calculators contained within the CACP software. Calculation-based methodologies calculate emissions using activity data and emission factors (which include regionally based factors that account for Bloomington's largely coal-dependent energy mix). Activity data refer to the relevant measurement of energy use or other greenhouse gas-

generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled.

As an example, the emissions associated with electricity purchased for a given facility would be calculated as follows:

Kilowatt-hours purchased x Emission factor = Emissions

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh of electricity).

CACP 2009 Software

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection 2009 (CACP 2009) software package in partnership with the National Association of Clean Air Agencies (NACAA) and the U.S. Environmental Protection Agency (EPA). CACP 2009 is designed for compatibility with the LGOP and determines emissions by combining activity data (energy consumption, waste generation, etc.) with verified emission factors.

The CACP software has been and continues to be used by over 600 U.S. local governments to reduce both energy use and greenhouse gas emissions. However, it is worth noting that, although the software provides governments with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation of reality, rather than an exact value.